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Distribution expansion of the Panamanian night monkey (*Aotus zonalis*) in Central America

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ABSTRACT

This work provides an updated distribution of *Aotus zonalis* in Panama, including a compilation of new localities, historical records, literature reviews, and citizen science reports. One new location from Los Santos Province and fifteen from Veraguas Province represent a westward expansion of approximately 100 kilometers of the continental distribution of *A. zonalis* in Central America; as well as confirmation of the species' current presence in Bocas del Toro Archipelago. We propose further research in the extreme west of Panama to better understand the distribution and conservation status of *A. zonalis* in the region.

Keywords: distribution, mammals, Panama, Panamanian night monkey, Primates

RESUMEN – Expansión de la distribución del mono nocturno panameño (*Aotus zonalis*) en Centroamérica. Este trabajo proporciona una distribución actualizada de *Aotus zonalis* en Panamá, incluyendo una compilación de nuevas localidades, registros históricos, revisión literaria y reportes de ciencia ciudadana. Una nueva localidad en la provincia de Los Santos y quince en la provincia de Veraguas, representan una expansión occidental de aproximadamente 100 km de la distribución continental de *A. zonalis* en Centroamérica, al igual que confirmamos la presencia actual de la especie en el Archipiélago de Bocas del Toro. Proponemos mayores investigaciones al extremo occidental de Panamá para conocer mejor la distribución y estado de conservación de *A. zonalis* en la región.

Palabras clave: distribución, mamíferos, mono nocturno panameño, Panamá, Primates

Aotus (Illiger, 1811) is a South American genus that includes 11 species (Defler & Bueno 2007; Fernandez-Duque 2007; Ruiz-García et al. 2011). *Aotus zonalis* (Goldman, 1914) is the only species of this genus in Central America. The type locality for this

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species is Gatun Lake (former Panama Canal Zone, Republic of Panama; hence the specific epithet). According to the Red List of Threatened Species of the International Union for Conservation of Nature, *A. zonalis* is considered Near Threatened –NT– globally (Méndez-Carvajal & Link 2021), whereas in the Republic of Panama, this species is listed as Vulnerable –VU– (Ministerio de Ambiente 2016).

The previously published distribution of *A. zonalis* ranged from the Pacific slope of Colombia to the Uraba Gulf region on the Caribbean, as far into Central America as central/western Panama (the border area between Veraguas, Coclé, and Colon Provinces) (Rylands et al. 2006; Méndez-Carvajal & Link 2021). The habitat of this species include mature, disturbed, and riparian forests, as well as early second-growth, rural and urban areas (Fernandez-Duque 2007; Svensson et al. 2010; González-Hernández et al. 2020). Due to its nocturnal habits (Wright 1989), *A. zonalis* might be unnoticed by people who are not familiar with the species' appearance and vocalization, which has led to unconfirmed reports from other localities, including Costa Rica (Timm 1988).

This work provides an updated distribution for *A. zonalis* throughout the Republic of Panama, including a compilation of historical records, literature reviews, citizen science reports (<https://panama.inaturalist.org/>), and 53 localities obtained by the authors between 2018–2021 (Fig. 1), of which 26 extend and/or confirm the distribution of the species.

The sightings were mainly made by scientists with experience identifying terrestrial and arboreal mammals while conducting field research, but also by eco-tourists and guides. The location of each report was georeferenced, and many have photographic evidence (see for example Fig. 2).

From the localities contributed by the authors, one is from Los Santos Province, and 15 are from Veraguas Province, representing a westward expansion of approximately 100 kilometers of the continental distribution of *A. zonalis* in Central America from the westernmost previously published records (González-Hernández et al. 2020; <https://panama.inaturalist.org/>) (Table 1).

Other ten localities contributed by the authors confirmed the current presence of *A. zonalis* in the Bocas del Toro Archipelago (Table 1), which in turn, validate reports of 13 specimens of *A. zonalis* from Isla Bastimentos and one from Isla Colón from 1962 to 1988 at the Smithsonian National Museum of Natural History (2021) (catalog numbers: USNM 323613, USNM 335426, USNM 335427, USNM 335428, USNM 335429, USNM 335430, USNM 335431, USNM 335432, USNM 335433, USNM 335434, USNM 335435, USNM 335436, USNM 464370, USNM 464844). Moreover, there were other historical records from the islands, like the one from Handley (1966), who reported night monkeys as *Aotus trivirgatus* (Humboldt, 1812), and Timm (1988), as *Aotus lemorinus* (Geoffroy, 1843). Furthermore, Timm (1988) presented the possibility that this species may be present in Costa Rica through anecdotal data, although he points out that historical reports from Costa Rica are possibly mistaken.

These new records include wooded areas between 0–850 m a. s. l., riparian vegetation, young second-growth, forest edge, mangroves, and islands. Moreover,

preliminary information on sightings in the Bocas del Toro Archipelago (Colon and Bastimentos islands) show groups of 3–5 individuals. Our results reveal the importance of further studies in this species' occurrence in the mainland of Bocas del Toro and its potential presence in nearby Costa Rica. Moreover, our findings highlight the ongoing role of the Isthmus of Panama in the biotic interchange of species between South America and North America (Webb 1976).

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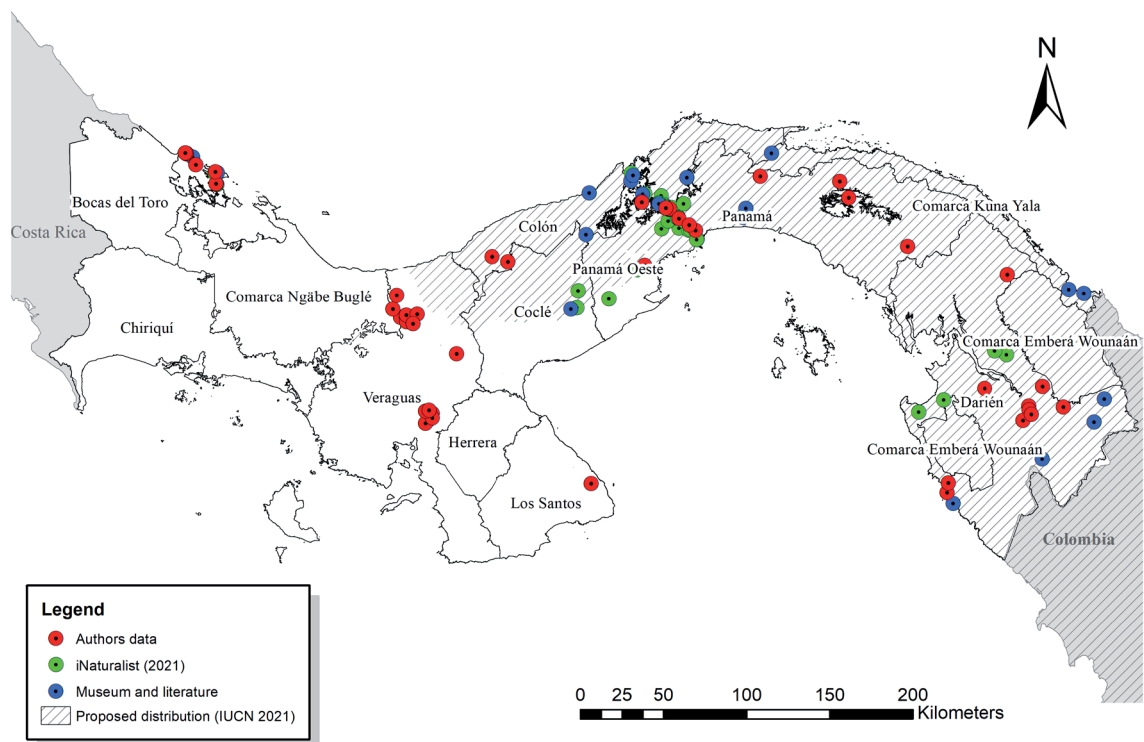


Figure 1. Actualization of the distribution of *Aotus zonalis* in Panama.



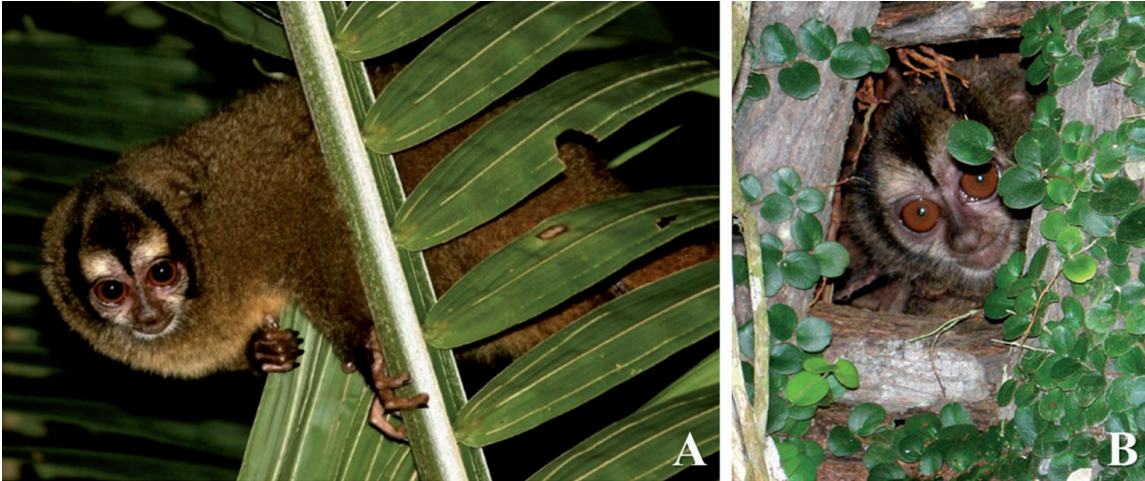


Figure 2. A) *Aotus zonalis* in Isla Bastimentos, Bocas del Toro; B) *Aotus zonalis* in Isla Colón, Bocas del Toro. Photographs by Ramón Fernández and Joe Maher.

Table 1. Extension and confirmed locations of *Aotus zonalis* in Panama.

New locations reported	Coordinates	
	Latitude	Longitude
Mi Ambiente Station, Santa Fe National Park, Veraguas	8.5331639	-81.1501306
Guabal, Santa Fe, Veraguas	8.5776333	-81.1924944
Río Luis, Santa Fe, Veraguas	8.6521639	-81.1713278
Alto de Piedra, Santa Fe, Veraguas	8.5090333	-81.1181028
Isleta, Santa Fe National Park, Veraguas	8.5444583	-81.1189972
Río Narices, Santa Fe National Park, Veraguas	8.5497722	-81.0613944
El Alto, Santa Fe, Veraguas	8.5183334	-81.0402777
El Tute, Santa Fe, Veraguas	8.4979000	-81.0824444
Cerro Atravezado, Calobre, Veraguas	8.3367944	-80.8484361
La Colorada, Santiago, Veraguas	8.0145417	-80.9794361
El Peligro, La Colorada, Santiago, Veraguas	7.9789111	-80.9989250
El Peligro, La Colorada, Santiago, Veraguas	7.9606778	-81.0164111
El Centeno, La Colorada, Santiago, Veraguas	7.9903861	-80.9785861
Paso Hondo, La Colorada, Santiago, Veraguas	8.0323583	-80.9971194
La Graciana, Montijo, Veraguas	8.0256750	-81.0150944
La Laguna, Pocrí, Los Santos	7.6339999	-80.1198333
Confirmed locations		
Colon Island Natural Reserve, Bocas Del Toro	9.3844444	-82.2579638
Colon Island, ITEC, Bocas Del Toro	9.4176722	-82.3073278
Colon Island, ITEC, Bocas Del Toro	9.4200806	-82.3093861
Colon Island, ITEC, Bocas Del Toro	9.4227972	-82.3136306
Colon Island, Finca Los Monos, Bocas Del Toro	9.3576917	-82.2571139
Bastimentos Island, Tranquilo Bay, Bocas Del Toro	9.2550472	-82.1465444
Bastimentos Island, Tranquilo Bay, Bocas Del Toro	9.2563722	-82.1476889
Bastimentos Island, Bahía Honda, Bocas Del Toro	9.3197417	-82.1524306
Bastimentos Island, Bocas Del Toro	9.2546570	-82.1454470
Bastimentos Island, Bocas Del Toro	9.3169600	-82.1554310

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